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Market Frictions and International Portfolio Diversification. Evidence from the S&P Global Index.

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Market Frictions and the Geographical Location of Global Stock Exchanges. Evidence from the S&P Global Index.

Abstract

We examine the impact of trading costs on investor average holding periods for the S&P global 1200 index. We report overwhelming evidence that global equity indices cannot be pooled. When we differentiate between stock indices based on their geographical location, we discover that for companies listed in the USA, Europe, Canada and Australia, there are no market frictions enabling continuous high frequency trading. However, companies listed in Latin America and Asia face significant barriers to trading in the form of transaction costs. We ascertain that the geographical location of stock markets plays a vital role in achieving international portfolio diversification.

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Keywords: Stock Market Liquidity; Geographical Location of Stock Exchanges; S&P 1200 Global Index.

Introduction

Investment theory is based upon the principle of minimizing risk through portfolio diversification. This encourages investors to spread their risk by investing in multiple assets. Therefore, from a theoretical perspective, investment in a global index can achieve diversification leading to higher risk adjusted returns. In reality this is not achieved because trading costs provide a stumbling block in trading a large number of equities. This is why there are numerous market microstructure studies that focus on the importance of trading costs in financial markets (see among others Stoll (1978), Atkins and Dyl (1997), Boinet et al (2008), and Florackis at al (2011)).

The academic literature computes the 'optimal holding period', for investors in the presence of new information by balancing the costs of portfolio matching with the gains from trading. Amihud and Mendelson (1986) and Wilcox (1993) provide the solution for the optimal holding period by an explicit proportional relationship between investors' holding periods, in the presence of transaction costs, and the arrival of new information. Atkins and Dyl (1997) and Gregoriou and Ioannidis (2006) undertake extensive econometric analysis that relate the bid-ask spread (used as a proxy for trading costs) to investors' holding periods. Their analysis involves all the stocks traded in the New York and the London Stock Exchange over the periods 1975-1989 and 1990-1999 respectively. In the context of static linear models, they find strong support for the postulated positive relationship between transaction costs as measured by the bid-ask spread and the holding period. Boinet et al (2008) discover that the speed of adjustment increases the greater the deviation of the holding period of an investor from its optimal value in the London Stock Exchange. They also find that for heavily traded stocks, even small misalignments of the holding period from its 'optimal' value, trigger trading. However, trading costs prevent such rapid adjustment in less liquid securities.

We contribute to the literature on holding periods and trading costs in a number of ways. First, we re-examine the empirical association between investor average holding periods and trading costs in a global context by analyzing stocks listed on the S&P Global 1200 Index, which covers approximately 70% of global market trading. This enables us to test if trading costs affect international portfolio diversification in a global framework rather than in just a US or a UK context. In our opinion this is a vital piece of research as we are the first study to witness if trading costs have an impact on international portfolio diversification, which is the fundamental focus of modern portfolio financial theory.

Second, given that the S&P Global 1200 Index consists of seven regional indices we are able to assess the pooling assumption of average holding periods and trading costs for indices across various geographical locations. In particular, we can determine whether you can cluster stocks listed in the USA, Canada, Latin America, Europe, Japan, Asia and Australia into the same empirical specification. This is a very important element to test because the pooled effects may not even provide consistent estimates of the average (Pesaran and Smith, 1995). This enables us to witness if the geographical location of stocks is a fundamental factor in achieving international portfolio diversification.

Third, unlike prior research we overcome contemporaneous correlation, endogeneity and jointly determination of investor average holding periods and trading costs by employing the Generalized Method of Moments (GMM) system panel estimator established by Blundell and Bond (1998) on our data. This makes our empirical estimates robust and therefore more reliable than the previous empirical research in this area conducted by Atkins and Dyl (1997) and Gregoriou and Ioannidis (2006).

Fourth, we undertake our empirical analysis on a very large comprehensive dataset consisting of 1200 stocks over a fifteen year period. Previous research used an extensively shorter time horizon and completed their research in 1999. We believe that the empirical literature requires updating in light of the evolution of high frequency trading (see among others Johnson and Jain (2006)) and the global financial crises that occurred in 2008. This is because high frequency trading could imply that trading costs are not a significant factor in deterring trading volume, which is contrary to earlier research. On the other hand, the financial crises might have caused a loss in confidence in equity markets thus decreasing trading volume, which may possibly lead to greater market frictions. Given these two significant issues occurring in financial markets over the last fifteen years, we believe that research in this field should provide more recent econometric analysis.

We provide empirical evidence that trading costs are a significant determinant in increasing investor average holding periods, when we look at the companies listed on the S&P Global 1200 Index as a whole. This supports the previous literature conducted on the US and UK equity markets in isolation.

When we proceed to test the validity of the pooling assumption of trading costs in global financial markets we discover some very interesting results. The objective is to determine if we can group all global data together into one testable model to compute the empirical relationship between trading costs and investor average holding periods of the 1200 firms listed on the S&P Global Index. We find overwhelming evidence that firms listed on the S&P 1200 Global Index cannot be pooled into a single regression model. Given this finding, we then assess whether the seven regional indices that make up the Global Index can be pooled.

The test results suggest that the pooling hypothesis cannot be rejected for companies listed on the S&P 500 index (US), TSX 60 Index (Canada), ASX 50 (Australia) and the S&P 350 Europe Index (Eurozone markets including Denmark, Norway, Sweden, and Switzerland; and the S&P United Kingdom). This result suggests that we can run a single econometric specification of each regional index for investor average holding periods and trading costs for companies listed in the USA, Canada, Australia and Europe. We therefore proceed to compute a regression where we attempt to explain investor average holding periods with trading costs for investment of companies in the USA, Europe, Canada and Australia. Our results imply that trading costs no longer provide a market friction to trading suggesting that high frequency trading can be utilized in order to achieve international portfolio diversification. From a practical point of view, fund managers can trade continuously to rebalance the portfolios of clients when they receive information to ensure that investors are full diversified against financial risk.

In addition, we find evidence that for companies listed on the S&P Latin America 40 Index (Mexico, Brazil, Peru, Chile, Colombia), S&P/TOPIX 150 Index (Japan) and the S&P Asia 50 Index (Hong Kong, Korea, Singapore, Taiwan) the data can also be pooled into one estimation for each regional index. Further econometric analysis reveals a positive and significant relationship between investor average holding periods and trading costs for these companies suggesting that transaction costs do provide significant obstacle in accomplishing international portfolio diversification.

Our results are robust to the global financial crises of 2008 and to the econometric problems of contemporaneous correlation, endogeneity and joint determination which are present in the data. Furthermore, our findings hold when we look at institutional trades, made up prominently of insurance, pension, mutual and investment funds which dominate the stock market.

Our findings indicate that the geographical location of exchanges could be a leading factor in preventing international portfolio diversification in global stock markets. This could indicate that stock indices located in Latin America and Asia have a liquidity problem. This could lead to the requirement of specialist market makers to provide liquidity for these equity markets, by allowing trading to occur outside the market makers' ask and bid quotes, in order to achieve stock market liquidity.[1]

The rest of the paper is organised as follows. The following section discusses the econometric specification; Section 3 discusses data and the tests of poolability; Section 4 presents the empirical results; and Section 5 summarises and concludes.

2. Econometric Specification

In order to conduct our empirical analysis we follow the mainstream literature on average holding periods and liquidity by estimating a similar linear specification to Atkins and Dyl (1997) and Gregoriou and Ioannidis (2006), which models the average holding period (H) holding period and a set of stock characteristics, of the form:

$$H_{it} = \alpha_i + b_t + \pi_1 S_{it} + \pi_2 MV_{it} + \pi_3 Vol_{it} + \varepsilon_{it} \quad (1)$$

Where i represents the companies within the index and t denotes the monthly time period; α_i captures the time-invariant unobserved average holding period firm-specific fixed effects (e.g., differences in the average level of investor holding periods), and the b_t captures the unobservable individual-invariant time effects (e.g., stock market shocks that affect all investors). The time dummies are of particular importance as they capture significant time effects throughout the sample on the change in the duration of average holding periods of assets held by investors. H_{it} is the average length of time that investors hold the stock of company i during month t. S_{it} is an estimate of the average percentage bid-ask spread (our proxy for trading costs) on the stock of company i's shares during month t. MV_{it} is the average market value of the stock of firm i during month t. Vol_{it} is the variance of return of

[1] Market Microstructure theory suggests that market makers buy (sell) stock at the bid (ask) price. However, in markets with high levels of trading costs, they can allow trades to occur outside the ask and bid quotes in order to obtain stock market liquidity.

the stock of company i during month t. An extensive discussion of these variable measures and their computational details are given in section 3.

In order to formally test the explanatory variables for endogeneity, a Hausman (1978) test for the hypothesis that the explanatory variables are strictly exogenous is performed. If the null hypothesis is rejected, it leads to the conclusion that the explanatory variables in equation (1) are endogenously determined. The Hausman test rejects the null hypothesis at all conventional significance levels.[2]

In order to accommodate endogeneity and the possibility of joint determination we employ a GMM system of equations in first differences and levels to estimate equation (1).[3] The estimation of the systems of equations simultaneously using the GMM system should be i) asymptotically efficient due to non-restrictive assumptions about error autocorrelation and heteroscedasticity (Biorn and Klette 1999), ii) accommodate the explanatory variables being jointly determined with investors' average holding periods of common stocks, iii) control possible relationships between the explanatory endogenous variables and the average holding period of stocks.

This system estimator combines the standard set of transformed equations in first differences (used in the GMM single equation estimator) with an additional set of equations in levels. The first set of transformed equations uses the lag levels as instruments and the level equation uses the lagged first differences as instruments. The first set of transformed equations continues to use the lag levels as instruments. The level equation, on the other

[2] The outcomes of the Hausman (1978) test are revealed in our econometric results.
[3] For further detail on the GMM system estimator in a panel framework, readers are referred to Blundell and Bond (1998).

hand, uses the lagged first differences as instruments. Their validity is based on the following two moment conditions:[4]

$$E\begin{bmatrix}(\alpha_{it}+\varepsilon_{it})\Delta H_{i,t-z}\\(\alpha_{it}+\varepsilon_{it})\Delta X_{i,t-z}\end{bmatrix}=0 \qquad \textit{for } z=1, \tag{2}$$

Where X_{it} is a vector of the explanatory variables, and z represents the lag structure in the econometric model.[5]

3. Data and Liquidity Heterogeneity

3.1 Data

In this study we collect monthly data from Datastream Advance for all the firms that are listed on the S&P Global 1200 Index over the time period of 2000-2014, resulting in 216,000 firm-year observations. This is a near comprehensive dataset given that the S&P Global 1200 Index was launched on 25th October 1999. We will now show the procedure used to obtain all the variables displayed in equation (1).

The average holding period, (H)

We calculate the average holding period for firm I at time period T as

$$\text{Average Holding Period}_{IT}=\frac{\text{Shares outstanding for firm I in month T}}{\text{Trading volume for firm I in month T}} \tag{3}$$

Thus, the average holding period of each firm's investors for each month is computed by dividing the number of outstanding shares in the firm by the firm's monthly trading volume.

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[4] The time-varying matrix of instruments for the first difference GMM estimator can be observed in Blundell and Bond (1998).

[5] The Three Stage Least Squares panel estimator also estimates a system of equations simultaneously and is regarded as an alternative to the GMM system estimator. However, we implement the GMM system estimator, given that it accommodates for the possibility of joint determination of an equation system with different instruments for different equations (Cornwell et al (1992)).

This average holding period, observed ex post, is a proxy for the average investors' ex ante investment horizon. The computation of investors' average holding period is only a crude approximation of investors' time horizons, because a particular firm's investors are unlikely to hold the firm's shares for the same length of time.

The bid-ask spread, S

Datastream Advance provides the bid and ask quotes originally used to compute the bid-ask spread for our research. The average monthly bid-ask spread for each stock in the data set is computed with the use of the formula proposed by Atkins and Dyl (1997) That is, the average spread for each stock I for each month T is computed as follows:

$$S_{IT} = \left[\frac{Ask_{IT} - Bid_{IT}}{\left(Ask_{IT} + Bid_{IT}\right)/2} + \frac{Ask_{IT-1} - Bid_{IT-1}}{\left(Ask_{IT-1} + Bid_{IT-1}\right)/2} \right] / 2 \qquad (4)$$

Where Ask_{IT} and Bid_{IT} are the ask and bid prices for the ith stock on the last trading day in month T.

Market Value, MV

The market values computed as the share price multiplied by the number of shares for all the firms that are listed on the S&P Global 1200 Index over the time period of 2000-2014, are obtained with the use of Datastream Advance.

The Variance of Returns, VOL

Daily prices of all the firms that are listed on the S&P Global 1200 Index over the time period of 2000-2014 are obtained with the use of Datastream Advanced. We then calculate the variance of the returns during the month of all the firms.

Once all the data has been collected for all the 1200 companies listed on the S&P Global 1200 Index over the time period of 2000-2014, we place each of the firms in our sample in one of the following seven stock indices in order to test the possible heterogeneity in stock market liquidity.

S&P 500.

Consists of the 500 leading companies with respect to market capitalization in the US economy. The index is widely used as a proxy for the US stock market as represents approximately 75% coverage of U.S. equities.

S&P Europe 350.

Consists of the 350 leading companies with respect to market capitalization in the European region. The index represents 70% of the region's market capitalization spanning seventeen exchanges.

S&P/TSX 60.

Consists of the 60 leading companies with respect to market capitalization in for Canada.

S&P/TOPIX 150.

Consists of the 150 leading companies with respect to market capitalization in the Tokyo market.

S&P/ASX Australian 50.

Consists of the 50 largest index-eligible Australian securities listed on the ASX.

S&P Asia 50.

Combining coverage of Hong Kong, Korea, Singapore and Taiwan, S&P Asia 50 measures four major markets in Asia. This index provides coverage of the 50 largest cap, liquid constituents of each of these key countries in Asia.

S&P Latin America 40.

The S&P Latin America 40 index includes the 40 largest market value securities from major sectors of the Brazil, Chile, Mexico and Peru equity markets.[6]

3.2 Liquidity Heterogeneity

We investigate data poolability through the tests of parameter homogeneity. We estimate Equation (1) and test the null of parameter (π_1) for equality of bid-ask spreads (our liquidity proxy) for all the firms listed on the S&P 1200 Global Index and between the firms listed on the seven regional indices based on geographical location that make up the S&P 1200 Global Index. We explicitly test poolability across these categories because we want to empirically examine the impact of the geographical location of indices on the liquidity of financial markets in a global context. If the null hypothesis is not rejected across the sample of categories, then this forms a basis for pooling the seven regional indices that form the S&P 1200 Global Index, because this essentially implies homogeneity in the average holding period of stocks and liquidity within each regional index that belongs to the S&P 1200 Global Index. We then test for the null of group-wise error homocsedasticity treating the liquidity of each regional index as a separate entity. A rejection of group-wise homoscedasticity indicates that the liquidity of each regional index heterogeneity is dynamic.

Chow-type F tests under the null of parameter equality across liquidity between the S & P 1200 Global Index and the seven regional indices based on their geographical location explained in Section 3.1 are reported in Tables 1 and 2. In Table 1 we report the results for the S&P 1200 Global Index as a whole. There is overwhelming econometric evidence that firms listed on the S&P 1200 Global Index cannot be pooled due to their significant differences in liquidity. The LM tests of group-wise homoscedasticity are also reported in

[6] Further details regarding the construction of the regional indices is available from the authors upon request.

Table 1, which confirm that error variances across all the firms in terms of liquidity are significantly different from each other (i.e., heteroscedastic). This implies that a single regression examining the empirical association between the liquidity and average holding periods is not applicable for the firms listed on the S&P 1200 Global Index.

[INSERT TABLE 1 HERE]

Motivated by the construction of the S&P 1200 Global Index, we investigate the poolability of firms that are listed on the index based on their geographical location. The regional indices results can be viewed in Table 2. We witness some very interesting and innovative econometric results. We find strong evidence which accepts the notion that firms listed within the seven regional indices (S&P Latin America 40, S&P/TOPIX 150, S&P Asia 50, S&P 500, TSX 60, ASX 50 and the S&P 350 Europe Index) can be pooled. Thus, the elasticity of block liquidity (spreads) with respect to firms listed on an index with respect to its geographical location are not significantly different. Therefore it is appropriate to run a single panel regression model of investor average holding periods and bid-ask spreads across the seven indices based on their geographical location that are displayed above. The results hold for both the Chow-type F tests under the null of parameter equality and the LM tests of group-wise homoscedasticity. [7]

[INSERT TABLE 2 HERE]

4. Empirical Results

4.1 Main Results

Even though the parameter equality results displayed in Table 1 suggest that we cannot pool the firms listed on the S&P 1200 Global Index, for completeness we initially report the

[7] Note that we do not report descriptive statistics in our study. This is because the main focus of the paper is on the heterogeneity of liquidity with respect to investor average holding periods, in a multivariate model accounting for endogeneity and joint determination in a panel framework. However, descriptive statistics are available from the authors upon request.

results for all the 1200 firms listed on the S&P Global Index. We do this to detect the impact of our findings if we did not undertake the extensive econometric analysis concerning parameter heterogeneity of liquidity. Table 3 reports the panel estimates for the estimation of Equation (1) for the S&P 1200 Global Index as a whole, which studies the effects of liquidity estimated by the bid-ask spread on investor average holding periods of stocks, after controlling for firm size and volatility. As a result of the parameter equality results reported in Tables 1 and 2 we repeat the exercise for firms listed on the S&P 500, TSX 60, ASX 50 and the S&P 300 index and for companies listed on the S&P Latin America 40, S&P/TOPIX 150 and the S&P Asia 50 index. The results can be seen in Tables 4 and 5 respectively.

[INSERT TABLES 3, 4 AND 5 HERE]

From Tables 3-5 we find, first of all, that the fixed and time effects are significant, suggesting that the firm and time-specific shocks differ significantly across the firms in our sample, justifying the use of the panel. The significance of the time dummies also imply that our estimates are robust to time varying conditions, in particular, the financial crises which occurred over the time period, 2007-2009 reaching its peak in 2008. In addition, all estimated models pass the diagnostic tests. A test for first order serial correlation is insignificant, which suggests that the panels do not suffer from serial correlation. The Jarque-Bera normality test indicates that the residuals of the models are normally distributed, implying that the empirical estimates obtained are not due to any outliers in the data. The Sargan tests confirm the validity of the instruments in all GMM system models. Thus, in summary, the results can be seen to be quite robust. Finally, we witness that for all panel estimations the control variables for firm size and volatility have the hypothesized signs and are significant at all conventional levels. We find that investors have longer average holding periods for stocks associated with larger firms that are less risky. This agrees with the previous research conducted by Atkins and Dyl (1997) and Gregoriou and Ioannidis (2006).

We observe some very interesting findings regarding the role of market frictions. Table 3 reports the results assuming a homogenous panel where we pool all the S&P 1200 Global Index into one signal panel estimation. We detect that the bid-ask spread is positive and significant when we analyse the S&P 1200 Global Index as a whole. This reaffirms the previous literature which states that market frictions cause a reduction in trading, resulting in longer average holding periods of stocks for investors.

However, once we allow for a heterogeneous panel based on our findings from Section 3.2, our results become very striking indeed. Table 4 reports the results of the companies listed on the S&P 500 index (US), TSX 60 Index (Canada), ASX 50 (Australia) and the S&P 350 Europe Index. We find that the bid-ask spread is insignificant suggesting that trading costs do not provide a stumbling block to international portfolio diversification, as they do not possess a significant impact on the frequency of trading.

This is an extremely prominent result as it suggests that investors should always trade when there is new information, which supports the notion of the recent developments in financial markets along the lines of high frequency trading. Furthermore, our results do not agree with the previous research conducted on the US and UK equity markets, where bid-ask spreads were found to be positive and significant. We believe that the differences can be explained through the evolution of high frequency trading demonstrated by the dramatic increases in the turnover of stocks listed on highly traded stock exchanges as reported in Florackis at al (2011).

Table 5 displays the results of the companies listed on the the S&P Latin America 40 Index (Mexico, Brazil, Peru, Chile, Colombia), S&P/TOPIX 150 Index (Japan) and the S&P Asia

50 Index (Hong Kong, Korea, Singapore, Taiwan). The econometric analysis reveals a positive and significant bid-ask spread, implying that trading volume is restricted by the presence of transaction costs.[8]

Our findings indicate that the geographical location of stock exchanges is an important element in where individuals choose to distribute their wealth. This is because if they invest in Latin America or Asia, they cannot rebalance their portfolios as easily then if they trade in North America, Europe or Australia. This possible prevention of international portfolio diversification in equity markets depending on their location can have significant long term economic growth problems in global stock markets. This could be because stock exchanges located in Latin America and Asia have a liquidity problem. As a consequence of this, they may require specialist market makers to provide liquidity for these equity markets, by allowing trading to occur outside the market makers' ask and bid quotes, in order to achieve stock market liquidity.

4.2 Robustness Tests

In order to validate our findings further we undertake the econometric analysis displayed above on large (block) transactions defined in the US (Madhavan and Cheng, 1997) and UK (Gemmill, 1996) stock exchanges as transactions of 10,000 shares or more in a single trade. We believe this is a good robustness test as block trades involve mostly institutional trades that essentially drive the stock exchange. In order to save space will place all the empirical results on block trades into Table 6. We can see from Table 6 that the results displayed in

[8] From equation (2) we see that the lag structure of the GMM in all our panel estimations is fixed at one lag. For robustness we repeat all the econometric analysis using a 2, 3 and 4 lag structure of the panel. The results are quantitatively similar and are available from the others upon request.

Tables 3-5 remain intact, suggesting that the geographical location of stock exchanges plays a vital role in portfolio diversification for insurance, pension, mutual and investment funds.[9]

[INSERT TABLE 6 HERE]

Our results have implications for operations research. This is because the influence of liquidity is becoming an emerging research area in the operational research field. For example Mercurio (2001) derives the bid-ask spread for a portfolio of assets and bonds. Albanese and Tompaidis (2008) show that trading costs provide a significant market friction to investor hedging strategies. Castellano and Cerqueti (2014) compute optimal portfolios for investors faced with thinly traded stocks characterized by their lack of liquidity. One of the shortcomings of the research conducted on liquidity in the operational research discipline is that is based purely on a theoretical framework. Therefore, we feel that an empirical piece of research showing the importance of trading costs in a global framework complements and extends the previous literature in the finance stream of operational research.

5. Conclusion

In this paper we initially examine the influence of trading costs on investor average holding periods in a global framework, by conducting our analysis on all the companies listed on the S&P Global 1200 Index as a whole. The results provide evidence that trading costs increase investor average holding periods of common stocks which agrees with financial theory and with the previous research undertaken on the US and UK equity markets in isolation.

When we proceed to test the validity of the pooling assumption of trading costs in global financial markets we discover some very interesting results. Our evidence suggests that we

[9] We also repeated the econometric analysis for the pooling non pooling tests shown in Tables 1 and 2. The results in Tables 1 and 2 do not change when we look at block trades. The results (not reported) are available from the authors upon request.

are able to compute a regression where we attempt to explain investor average holding periods with trading costs for investment of companies in the USA, Europe, Canada and Australia. Our results imply that trading costs no longer provide a market friction to trading suggesting that high frequency trading can be utilized in order to achieve international portfolio diversification. From a practical point of view, fund managers can trade continuously to rebalance the portfolios of clients when they receive information to ensure that investors are fully diversified against financial risk.

In addition, we find overwhelming evidence that for companies listed on the S&P Latin America 40 Index (Mexico, Brazil, Peru, Chile, Colombia), S&P/TOPIX 150 Index (Japan) and the S&P Asia 50 Index (Hong Kong, Korea, Singapore, Taiwan) the data can also be pooled. Further econometric analysis reveals a positive and significant relationship between investor average holding periods and trading costs for these companies suggesting that transaction costs do provide significant residence in accomplishing international portfolio diversification.

Our results are robust to the global financial crises of 2008 and to the econometric problems of contemporaneous correlation, endogeneity and joint determination, which are present in our data. Furthermore, our findings hold when we look at institutional trades, made up prominently of insurance, pension, mutual and investment funds which dominate the stock market.

Our findings specify that the geographical location of exchanges could be a leading factor in preventing international portfolio diversification in global stock markets. This could indicate that stock indices located in Latin America and Asia have liquidity problems. This could lead to the requirement of specialist market makers to provide liquidity for these equity markets, by allowing trading to occur outside the market makers’ ask and bid quotes, in order to achieve stock market liquidity. Finally, avenues for future research could include investigations of alterative liquidity measures to the bid-ask spread. In particular, the price impact ratios of Amihud (2002) and Florackis et al (2011) could be implemented to provide further robustness to our empirical findings.

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TABLES

TABLE 1: Heterogeneous Liquidity Effects of Trading Costs on Average Holding Periods of Common Stocks listed on the S&P 1200 Global Index

The specification is $H_{it} = \alpha_i + b_t + \pi_1 S_{it} + \pi_2 MV_{it} + \pi_3 Vol_{it} + \varepsilon_{it}$ where i represents the companies within the index and t denotes the monthly time period; α_i captures the time-invariant unobserved average holding period firm-specific fixed effects (e.g., differences in the initial level of investor average holding periods), and the b_t captures the unobservable individual-invariant time effects (e.g., stock market shocks that affect all investors). The time dummies are of particular importance as they capture significant time effects throughout the sample on the change in the duration of average holding periods of assets held by investors. H_{it} is the average length of time that investors hold the stock of company i during month t. S_{it} is an estimate of the average percentage bid-ask spread on the stock of company i's shares during month t (our proxy for trading costs). MV_{it} is the average market value of the stock of firm i during month t. Vol_{it} is the variance of return of the stock of company i during month t. The cross-size parameter equality (i.e., the equality of $\pi_1's$ across the 1200 firms listed on the S&P 1200 Global Index) is tested by the standard (Chow type) F-tests, and error variance equality of trading costs across the 1200 companies listed on the S&P 1200 Global Index is conducted with the use of Lagrange Multiplier (LM) tests of homogeneity. Figures in brackets represent the *p-values* of the F and chi squared statistics, which are obtained through bootstrap simulations, given the lack of availability of suitable critical values from statistical tables due to our large sample size. * denote statistical significance at all conventional levels.

Panel A. Parameter Equality (F Test)

Index	Bid-Ask Spread
S&P 1200 Global	3.53 (0.00)*

Panel B. Parameter Variance Equality (LM Test)

Index	Bid-Ask Spread
S&P 1200 Global	3.00 (0.00)*

TABLE 2: Heterogeneous Liquidity Effects of Trading Costs on Average Holding of Seven Regional Indices that make up the S&P 1200 Global Index

The specification is $H_{it} = \alpha_i + b_t + \pi_1 S_{it} + \pi_2 MV_{it} + \pi_3 Vol_{it} + \varepsilon_{it}$ where *i* represents the companies within each of the seven regional indices that make up the index and *t* denotes the monthly time period; α_i captures the time-invariant unobserved average holding period firm-specific fixed effects (e.g., differences in the initial level of investor average holding periods), and the b_t captures the unobservable individual-invariant time effects (e.g., stock market shocks that affect all investors). The time dummies are of particular importance as they capture significant time effects throughout the sample on the change in the duration of average holding periods of assets held by investors. H_{it} is the average length of time that investors hold the stock of company i during month t. S_{it} is an estimate of the average percentage bid-ask spread on the stock of company i's shares during month t (our proxy for trading costs). MV_{it} is the average market value of the stock of firm i during month t. Vol_{it} is the variance of return of the stock of company i during month t. The cross-size parameter equality (i.e., the equality of π_1's across firms listed on the seven regional indices that make up the S&P 1200 Global Index) is tested by the standard (Chow type) F-tests, and error variance equality of trading costs across the seven regional indices that make up the S&P 1200 Global Index is conducted with the use of Lagrange Multiplier (LM) tests of homogeneity. Figures in brackets represent the *p-values* of the F and chi squared statistics, which are obtained through bootstrap simulations, given the lack of availability of suitable critical values from statistical tables due to our large sample size. * denote statistical significance at all conventional levels.

Panel A. Parameter Equality (F Test)

Index	Bid-Ask Spread
S&P 500	0.32 (0.50)
TSX 60	0.34 (0.51)
ASX 50	0.35 (0.53)
S&P 300	0.30 (0.48)
S&P Latin America 40	0.22 (0.54)
TOPIX 150	0.30 (0.52)
S&P Asia 50 Index	0.35 (0.60)

Panel B. Parameter Variance Equality (LM Test)

Index	Bid-Ask Spread
S&P 500	0.50 (0.33)
TSX 60	0.52 (0.31)
ASX 50	0.44 (0.36)
S&P 300	0.40 (0.40)
S&P Latin America 40	0.30 (0.22)
TOPIX 150	0.29 (0.21)
S&P Asia 50 Index	0.36 (0.25)

TABLE 3. Holding Periods and Trading Costs GMM Panel Estimates for the firms listed on the S&P 1200 Global Index, over the time period 2000-2014.

The specification is $H_{it} = \alpha_i + b_t + \pi_1 S_{it} + \pi_2 MV_{it} + \pi_3 Vol_{it} + \varepsilon_{it}$ where i represents the companies within the index and t denotes the monthly time period; α_i captures the time-invariant unobserved average holding period firm-specific fixed effects (e.g., differences in the initial level of investor average holding periods), and the b_t captures the unobservable individual-invariant time effects (e.g., stock market shocks that affect all investors). The time dummies are of particular importance as they capture significant time effects throughout the sample on the change in the duration of average holding periods of assets held by investors. H_{it} is the average length of time that investors hold the stock of company i during month t. S_{it} is an estimate of the average percentage bid-ask spread on the stock of company i 's shares during month t (our proxy for trading costs). MV_{it} is the average market value of the stock of firm i during month t. Vol_{it} is the variance of return of the stock of company i during month t. AR(1) is the first order Lagrange Multiplier test for residual serial correlation, undertaken on the residuals for the SUR estimates and on the first difference of the residuals for the GMM system because of the transformations involved. SE represents the standard error of the panel estimator. Sargan tests follow a χ^2 distribution with r degrees of freedom under the null hypothesis of valid instruments. Note: the Difference-Sargan test is applicable to the GMM system estimator due to the transformations involved. To establish the validity of the instrument set. NORM(2) is the Jarque-Bera normality test. The Hausman test follows a χ^2 distribution with 4 degrees of freedom, resulting in a critical value of 9.49, at the 95% confidence level. The endogenous explanatory variables in the panel are GMM instrumented setting, $z = 1$. (.) are p values, **(.)** are t statistics, * indicate significant at the 5% level.

Variable	**S&P 1200 Global Index**
Constant	16.44 **(2.88)***
Bid-Ask Spread	1.89 **(2.33)***
Market Value	0.67 **(2.53)***
Volatility	-0.47 **(-2.21)***
α_i	(0.00)
b_t	(0.00)
SE	0.50
AR(1)	(0.39)
NORM(2)	(0.40)
Diff Sargan	(0.67)
Hausman test	90.23
R^2	0.54
Observations	216,000

TABLE 4. Holding Periods and Trading Costs GMM Panel Estimates for the firms listed on the S&P 500, TSX 60, ASX 50, and the S&P 350 Europe Index, over the time period 2000-2014.

See notes for TABLE 3.

Variable	**S&P 500 Index**	**TSX 60 Index**	**ASX 50 Index**	**S&P 350 Europe Index**
Constant	17.23 **(2.10)***	18.25 **(2.94)***	16.21 **(2.56)***	15.44 **(2.22)***
Bid-Ask Spread	0.33 **(0.67)**	0.55 **(0.98)**	0.63 **(1.11)**	0.22 **(0.22)**
Market Value	0.83 **(2.84)***	0.90 **(2.66)***	0.73 **(2.29)***	0.66 **(3.01)***
Volatility	-0.33 **(-2.98)***	-0.39 **(-2.47)***	-0.44 **(-2.55)***	-0.28 **(-2.26)***
α_i	(0.00)	(0.00)	(0.00)	(0.00)
b_t	(0.00)	(0.00)	(0.00)	(0.00)
SE	0.63	0.88	0.93	0.70
AR(1)	(0.44)	(0.41)	(0.33)	(0.37)
NORM(2)	(0.56)	(0.60)	(0.40)	(0.30)
Diff Sargan	(0.50)	(0.58)	(0.62)	(0.66)
Hausman test	83.20	81.00	77.32	75.21
R^2	0.44	0.25	0.22	0.38
Observations	90,000	10,800	9,000	63,000

TABLE 5. Holding Periods and Trading Costs GMM Panel Estimates for the firms listed on the S&P Latin America 40, S&P/TOPIX 150, and the S&P Asia 50 Index, over the time period 2000-2014.

See notes for TABLE 3.

Variable	S&P Latin America 40 Index	S&P/TOPIX 150 Index	S&P Asia 50 Index
Constant	21.33 **(3.84)***	23.44 **(3.03)***	24.21 **(2.92)***
Bid-Ask Spread	2.33 **(2.67)***	2.22 **(2.34)***	2.41 **(2.50)***
Market Value	0.99 **(2.12)***	0.90 **(2.33)***	0.88 **(2.28)***
Volatility	-0.66 **(-2.98)***	-0.44 **(-2.83)***	-0.72 **(-2.44)***
α_i	(0.00)	(0.00)	(0.00)
b_t	(0.00)	(0.00)	(0.00)
SE	0.88	0.70	0.86
AR(1)	(0.50)	(0.32)	(0.21)
NORM(2)	(0.61)	(0.64)	(0.51)
Diff Sargan	(0.44)	(0.32)	(0.28)
Hausman test	62.44	68.22	63.11
R^2	0.18	0.28	0.20
Observations	7,200	27,000	9,000

TABLE 6. Holding Periods and Trading Costs GMM Panel Estimates of Block Trades for the firms listed on the seven regional indices that make up the S&P 1200 Global Index, over the time period 2000-2014.

See notes for TABLE 3. Block Trades are defined as an exchange of 10,000 shares or more in a single transaction.

Variable	S&P 1200 Global Index	S&P 500 Index	TSX 60 Index	ASX 50 Index	S&P 350 Europe Index
Constant	19.33 **(2.66)***	20.11 **(2.19)***	23.46 **(3.05)***	24.12 **(2.72)***	16.22 **(2.88)***
Bid-Ask Spread	1.62 **(2.11)***	0.20 **(0.54)**	0.12 **(0.76)**	0.29 **(1.00)**	0.24 **(0.58)**
Market Value	0.52 **(2.33)***	0.32 **(2.13)***	0.20 **(2.46)***	0.18 **(2.20)***	0.44 **(2.40)***
Volatility	-0.38 **(-2.15)***	-0.28 **(-2.47)***	-0.11 **(-2.99)***	-0.29 **(-2.62)***	-0.46 **(-2.28)***
α_i	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
b_t	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
SE	0.70	0.86	0.94	1.04	0.78
AR(1)	(0.21)	(0.39)	(0.16)	(0.19)	(0.33)
NORM(2)	(0.29)	(0.43)	(0.19)	(0.28)	(0.36)
Diff Sargan	(0.34)	(0.49)	(0.32)	(0.21)	(0.27)
Hausman test	65.21	55.23	44.32	40.21	60.43
R^2	0.33	0.21	0.18	0.16	0.26
Observations	97200	40,500	4,860	4,050	28,350

Variable	S&P Latin America 40 Index	S&P/TOPIX 150 Index	S&P Asia 50 Index
Constant	26.45 **(3.00)***	30.22 **(3.66)***	28.11 **(2.81)***
Bid-Ask Spread	1.33 **(2.19)***	1.78 **(2.24)***	2.02 **(2.99)***
Market Value	0.66 **(2.27)***	0.54 **(2.48)***	0.98 **(2.44)***
Volatility	-0.59 **(-2.80)***	-0.31 **(-2.41)***	-0.95 **(-3.01)***
α_i	(0.00)	(0.00)	(0.00)
b_t	(0.00)	(0.00)	(0.00)
SE	0.99	1.08	1.24
AR(1)	(0.41)	(0.28)	(0.30)
NORM(2)	(0.33)	(0.39)	(0.60)
Diff Sargan	(0.19)	(0.28)	(0.20)
Hausman test	56.22	50.21	49.87
R^2	0.14	0.20	0.17
Observations	3,240	12,150	4,050